

## 11. Health and Safety

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| Needs to Know Criteria |   |
|------------------------|---|
| ▪                      | Types of personal protective equipment                                |
| ▪                      | Wastewater land application site health and safety hazards            |
| ▪                      | Health and safety measures to minimize health and safety hazards      |
| ▪                      | Public health risks associated with wastewater land application sites |

Accidents and injuries do not just happen; they are caused. Behind every accident is a chain of events that leads up to an unsafe act, unsafe conditions or a combination of both.

Communication between supervisors and employees generates ideas and safety awareness that leads to accident prevention. Safety programs, safety manuals, and safety meetings are essential in providing the lines of communication that lead to a safe, accident-free workplace.

### 11.1 Regulatory Overview

A variety of federal and state laws and regulations exist to protect workers in both the private and public sectors. At the federal level, the regulatory agency that oversees worker safety is the U.S. Occupational Safety and Health Administration (OSHA). OSHA oversight does not include state or local government employees. In Idaho, state and local government public employee safety and health are overseen by the Idaho Division of Building Safety.

#### Employer Responsibilities

The employer or owner of a wastewater land application site has responsibility to do the following:

- Provide a workplace that is free from recognized hazards that are causing or likely to cause serious injury or death.
- Furnish and require use of safety devices and safeguards, safe work practices and procedures, and operations and processes that are adequate to ensure employees are safe while performing their jobs.
- Comply with all Occupational Health and Safety Administration (OSHA) and/or state standards.

#### Site Supervisor Responsibilities

The site supervisor has responsibility to do the following:

- Establish and supervise a Health and Safety Program that is designed to improve the safety and health skills and competency of all employees.

- Conduct preliminary investigations to determine the cause of any accident that results in injury. The results of this investigation should be documented for reference.
- Establish and maintain a system for maintaining records of occupational injuries and illnesses.
- Provide new employees with a safety orientation on the special hazards and precautions of any new job.
- Conduct job briefings with employees before starting any job, to acquaint employees with any unfamiliar procedures.
- Issue any needed safety equipment and manuals.
- Conduct periodic group safety meetings.

## Employee Responsibilities

Employees have the responsibility to do the following:

- Comply with OSHA and/or state standards and rules that are applicable to their own actions and conduct.
- Keep informed of current safe work practices and procedures.
- Be responsible for their own safety.
- Request instruction from the site supervisor if there is a question as to the safe performance of work assigned.
- Use appropriate safety devices and wear suitable clothing and appropriate personal protective equipment (PPE).
- Report **any** unsafe conditions, practices or procedures to the site supervisor

## 11.2 Health and Safety Program

As mentioned above, it is the site supervisor's responsibility to develop a Health and Safety Program. This program should include:

- Procedures for reporting incidents, injuries, and unsafe conditions or practices
- Instructions on identification and safe use of hazardous gases, chemicals and materials and emergency procedures following exposure
- Use and care of personal protective equipment

## Incident Reporting

As part of the Health and Safety Program, all facilities should develop a formal incident reporting and investigation program. All incidents, including injuries, accidents and near misses should be reported to the site supervisor immediately, and these incidents should be investigated as soon as possible to determine their root causes.

The information gained from an investigation should then be used to change work practices and to eliminate hazardous activities. Injuries requiring treatment other than first aid treatment must be reported on OSHA 200 form (Log and Summary of Injuries and Illnesses).

## Hazard Communication Standard

The *Hazard Communication Standard*, mandated by OSHA, is another important component of any Health and Safety Plan. The goal of the Hazard Communication standard is to reduce injuries and illnesses resulting from improper use, storage, etc., of chemicals in the workplace. Employers must inform or instruct employees about the following, regarding chemicals that are used in the workplace:

- safety and health standards for the safe use of chemicals
- known health hazards of the chemicals used in the workplace
- methods of hazard control
- proper labeling of containers
- maintaining current *material safety data sheets* (MSDS) on all chemicals
- chemical inventory
- procedures to use in normal use or a foreseeable emergency
- training in recognizing, evaluating and controlling hazards

## Chemical Hygiene Plan

Another standard that goes hand in hand with the Hazard Communication Standard is the *Laboratory Standard*, or more exactly, the *Occupational Exposure to Hazardous Chemicals in Laboratories Standard*. Facilities that have a laboratory that performs analytical tests may need to develop a *chemical hygiene plan*. A chemical hygiene plan includes instruction on the following the following topics:

- how laboratory personnel handle and work with hazardous laboratory chemicals
- how employee exposure to these chemicals will be minimized
- what personal protective equipment will be used in the laboratory; and
- specifications for working with particularly hazardous substances, such as cancer causing chemicals, and certain other requirements.

The requirements of the laboratory standard can be found in the OSHA regulation 29 CFR 1910.1450, including the appendices. This plan must be a written plan and must be evaluated on a regular basis for effectiveness.



## Personal Protective Equipment

Another important component of a Health and Safety Program is a written program covering the appropriate selection, use, and maintenance of personal

protective equipment (PPE). The proper selection and use of personal protective equipment is one of the most effective methods for preventing occupational injuries and illnesses. Types of personal protective equipment include the following:

- head protection
- eye and face protection
- hearing protection
- foot and leg protection
- body protection
- respiratory protection

### *Head Protection*

Any head injury has the potential to be serious. Any injury that results in brain damage can cause memory loss, affect the ability to reason, and cause changes in personality and emotions. Any of these changes can result in disability and interfere with the ability to earn a living. Fortunately, there is a wide variety of protective equipment suitable for the activities normally associated with wastewater treatment facilities:

- *Bump caps* are lightweight plastic caps designed to protect the head from bumps and scrapes encountered in tasks such as building and machinery maintenance. A bump cap will not provide protection from impact, such as a dropped tool or other heavy object, but bump caps are recommended for tasks where cleanliness and sanitation are high priorities, such as in food processing plants or when handling pesticides. A bump cap or hard hat can be decontaminated with soap and water, but a baseball cap or cowboy hat cannot be completely decontaminated of chemicals.
- *Safety helmets* (commonly referred to as 'hard hats') are primarily intended to protect the head from falling objects, although they can also provide protection from flying objects. A hard hat consists of a sturdy shell, usually made of plastic, and a suspension that holds the shell at least 1¼ inches from the head. When an object strikes the hat, the force is distributed through the suspension to a large area of the head and neck, preventing puncture wounds and concussion injuries in most cases. Hard hats are recommended for all construction and timber harvesting activities and any other tasks involving the risk of bumps or falling objects. While a hard hat may not be able to protect a person from a severe, direct blow, it can deflect many glancing blows that might otherwise result in serious injury or death.

Accessories that can be mounted on a hard hat include welding helmets, face shields, hearing protectors and communications devices. These are useful because several PPE items needed for a particular task can be kept together. For example, a hard hat with a face screen and hearing protectors is ideal for chain saw operation.

Although hard hats are heavier than baseball caps, they are cooler than baseball caps because there is an air space between the head and shell. This coolness is welcomed in summer, but a liner is often needed in winter to maintain comfort.

Accidents, abuse or improper care can damage any type of protective headgear. Remember these points:

- Always replace any protective headgear that has received a hard blow, because it may have sustained damage that is not visible.
- Never wash any protective headgear with anything stronger than mild detergent and water. Solvents can weaken or destroy the plastics used for protective headgear.

**Note:** Use safety helmets that comply with the American National Standards Institute (ANSI) Z89.1 criteria. Never use a metal hard hat when working around electrical systems.

### *Eye and Face Protection*

Our eyes are one of the most vulnerable parts of our bodies. Chemical burns, flying particles, cuts, heat, light, and blows to the head or face cause eye injuries. Eye and face protective devices include face shields, safety glasses, and goggles.

Safety glasses are available in a wide variety of styles and can be equipped with or without side shields. Lenses can be made of plastic or heat treated/chemically treated glass. Metal frames should not be worn in an electrical hazard area.

Goggles can be worn over regular prescription eyewear. Goggle frames are made of molded synthetic rubber, natural rubber or vinyl, and lenses are made of plastic, acetate, or glass. Goggles with ventilation should be used where fogging is a problem. In areas where dust, smoke, aerosols, chemical splashes or fumes can irritate eyes, goggles without ventilation should be used.

Face shields provide additional protection for eyes and should only be worn over primary eye protection. They also provide protection for the nose, mouth, and throat. Face shields are generally made of plastic but are available in reflecting metal screen where radiant heat is a problem. Face shields can be attached directly to a hard hat.

### *Hearing Protection*

Noise is a fact of life; however, noise above a certain level can be harmful and cause permanent hearing damage. Noise can come from a variety of sources, such as gasoline or diesel engines, gas or electric blowers, mechanical equipment, spreaders, and other types of machinery.

Each employer is required to determine if noise above what is called the “action level” exists in the workplace. If so, actions must be taken to reduce the noise level and protect the employees. The employer is required to develop a “hearing conservation program” which is designed to effectively limit employee exposure to harmful levels of noise.

OSHA regulation 1910.95 stipulates what a minimum level hearing conservation program must contain and provides guidance for employers to develop their own effective program. In essence, the hearing conservation program states that employees must wear proper ear protecting devices whenever they are working in a noise hazard area. Hearing protection devices include earplugs, earmuffs, and semi-aurals or canal caps.



### *Hand and Arm Protection*

One of the best methods of protecting the hands (and preventing dermatitis elsewhere) is to thoroughly wash the hands with soap and water and dry them with single-use towels when finishing a task, before eating and after using the restroom.

Gloves also provide hand and arm protection, and they are available in a wide variety of styles and materials, each having its advantages and disadvantages. Since there is no single type of glove that is suitable for all tasks, it is important to understand a few basics of selecting gloves. When determining the types of gloves to use you may want to ask yourself the following questions:

- Do you need protection from cuts and scrapes, protection from heat, or protection from chemicals?
- Are the hazards low, moderate or high?
- Do you need to wear gloves all day, or intermittently?
- Do you need good manual dexterity for handling controls, tools or small objects?

Glove selection becomes complicated when a situation involves several hazards or types of tasks.

Chemical labels are required to give specific recommendations for personal protective equipment, including gloves. You *must* use the PPE stated on the label to comply with federal and state regulations. Check the label for PPE recommendations, or refer to a chemical resistance chart (featured in safety product catalogs), and select a material that provides good to excellent resistance from the chemicals you will be exposed to. Never use leather or fabric gloves when handling toxic chemicals—chemicals readily penetrate these materials, and they can never be fully decontaminated.

Gloves are made from many materials. You may need three to four types of gloves to meet your needs. Your choices will depend on the specific needs for protection from chemical and physical hazards:

- *Fabric* (jersey, cotton flannel, knit, etc.) gloves are inexpensive and suitable for many tasks where protection is needed from minor cuts and scrapes. Cloth gloves are also ideal for tasks where protection is needed from friction or when a glove might aid in gripping objects. Gloves with dimples or rubberized fabric on the palms and fingers are excellent when using hand tools and other similar tasks.

Some fabrics are also used for high temperature applications, such as welding. These may be more flexible than leather welding gloves, but can result in serious burns if they are wet when a hot object is picked up—unless they have a moisture barrier. A significant advantage of cloth gloves is that they breathe well, minimizing perspiration buildup.

- *Leather* is possibly the best all-around choice for protection from cuts, scrapes, friction, and other physical hazards. Leather is tough, flexible, inexpensive, and it breathes well. Leather can be sewn into a wide variety of gloves, and it may be used in conjunction with other materials for specialized purposes. For example, Kevlar® (the material used in body armor for police

officers) is used in gloves for chain saw operators to provide extra protection from cuts should the left hand come in contact with the moving chain. Another example is the insulating materials sewn inside gloves used by welders to protect them from burns.

- *Rubber* gloves are needed for protection from the wide variety of chemicals that may be used at a spray irrigation site. However, there are several ‘rubber’ materials used for gloves today, and it is important that the correct material be used. Using the wrong material can allow chemicals to penetrate through the gloves or cause the gloves to deteriorate. Always refer to the manufacturer’s chemical resistance chart and glove selection guidelines when selecting rubber gloves.
- *Cut-resistant materials* such as Kevlar®, steel reinforced fabrics, and chain link mesh are used in gloves designed for tasks where cuts are a major risk, such as handling glass and other sharp objects. Although these materials can be cut, they offer superior protection while permitting the user to grasp tools and other objects. Cut-resistant gloves often feature slip-resistant materials or textures on the fingers and palm to minimize the risk of sharp objects slipping through the hands, thus reducing the risks of a cut.

Whatever type of gloves you chose, remember these points:

- Gloves should be thick enough to provide adequate chemical resistance and prevent punctures or tears, yet thin enough to provide a good grip and manual dexterity. Examination gloves (like doctors use) are not adequate for protection from most chemicals, especially pesticides.
- Unlined gloves are normally recommended when using chemicals since they can be easily washed and decontaminated. Flock-lined gloves are more comfortable, however, and often cost less than unlined gloves. Any lined gloves should be disposed of if contaminated inside by chemicals.
- The color of the gloves will affect comfort, especially outdoors. Black gloves will absorb heat from the sunlight, making them uncomfortable, so select a lighter color for outdoor work.
- Cut, length and thickness affect the comfort and performance of any glove. Some gloves may be so heavily constructed that they will last forever - because they are too stiff or otherwise uncomfortable to be used on a routine basis. Gloves that are too heavy or uncomfortable, or which do not fit well, can significantly reduce a worker’s productivity by making it difficult to handle tools and other objects. Those gloves can also be dangerous in certain situations. Other gloves may be very comfortable, but not durable enough to provide satisfactory performance and economy. The ideal glove fits well, provides the needed protection, permits good productivity and is economical. If there are several workers, it is likely that several styles or sizes of gloves will be needed. Try several styles of gloves to determine which provides the best comfort, grip and dexterity needed for the intended tasks.

### *Foot and Leg Protection*

Injuries to the feet are uncomfortable at best, and they can seriously interfere with the ability to accomplish work activities. Although most foot injuries are not serious, they do result in pain and lost production. Injuries resulting from dropped

dropped objects, punctures, and strains or sprains due to slips and falls are probably the most common. Most of these can be prevented through a combination of safe work practices and use of proper footwear. While you may not always need to wear high-top steel-toe boots with steel shank and lug soles, you probably should wear them some of the time. Sneakers and smooth soled shoes are not good because they do not provide protection from commonly encountered hazards.

Perhaps the most important aspect of good footwear is a non-slip sole. Good traction is needed to prevent slips and falls while walking on various surfaces, and especially when climbing ladders and stairs. Smooth leather soles common on western boots and dress shoes may be too slippery on many surfaces. Soles with lugs or texture may provide better traction, especially when made of the soft, yet long wearing materials found in quality boots. A steel shank can provide improved puncture resistance as well as improved support in activities that place concentrated loads on the feet, such as prolonged work on ladders or repeatedly pressing machinery brake pedals.

Steel toe safety shoes are intended to protect the toes from injuries caused by dropped objects. While steel toecaps are very effective in preventing injuries to the toes, they will not protect the rest of the foot. Like any shoes or boots, safety shoes will not be comfortable unless they fit properly. Most reputable safety shoe dealers can fit all sizes and widths from AAAA to EEE. If they fit properly, the steel toe cap will only be noticed if it prevents an injury, when you are squatting, or otherwise have your toes bent far back, or if you kick something and push your toes against the toe cap.

Safety shoes are available in a wide variety of styles, including dress shoes and western boots, as well as leather and rubber work boot styles. Some special purpose boots are available that incorporate instep guards to prevent injuries behind the toes, Kevlar® pads to prevent cuts from chain saws, caulks (screw-in spikes) to prevent slips when working on logs or ice.

Rubber boots are recommended for tasks involving prolonged contact with water or whenever there is a risk of exposure to hazardous chemicals, such as pesticides. Just as when selecting rubber gloves, make sure the material is suitable for the exposure. To prevent water and chemicals entering the top of the boot, place the coveralls *outside* the boot to shed water onto the ground.

A consideration that is often overlooked when using rubber boots is perspiration removal. Because rubber boots do not breathe, perspiration cannot readily escape, so the socks and feet will eventually be soaked with perspiration. Keeping the feet dry is essential for good health, so proper measures must be taken. Socks of polypropylene and cotton blends can help wick the moisture away, and moisture absorbent liners are available as well. Remove the boots and allow the feet to 'breathe' and dry occasionally. To help prevent foot health problems always wash and dry the feet at the end of each day, allow footwear to dry and air out between uses, and begin each day with clean, dry socks.

### ***Body Protection***

The skin is your body's largest organ, and it performs a number of vital functions: keeping moisture in; sweating to cool your body; and keeping harmful agents from entering the body. Because the skin is exposed to so many hazards, it is important to protect it. While the skin can adequately protect the body from many



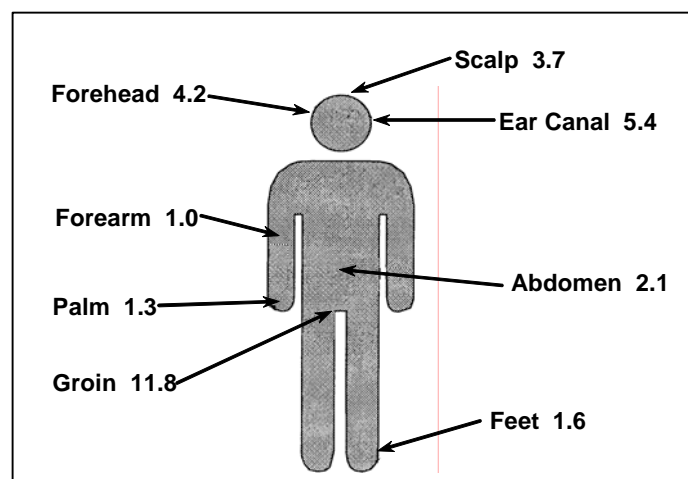
many hazards (such as most bacteria), it can easily be penetrated or damaged by many chemicals. Another alarming fact is the increased incidence of skin cancers resulting from sun exposure. People who spend long hours in the sun are at increased risk of developing skin cancer unless they take protective measures.

Friction, scrapes and cuts are also common sources of skin injuries and irritation. Properly selected clothing can prevent or minimize the chances of many skin disorders. 'Normal' clothing can prevent many types of skin problems. For example, a light colored long-sleeve shirt can protect the arms and upper body from sunburn and reduce the risks of skin cancers, and the long-sleeve shirt may actually be cooler than a short-sleeve shirt when working in the sun because it will reflect the sunlight. Other clothing that helps prevent sunburn and skin cancer includes a wide-brimmed hat to protect the ears, face, and neck, and long pants to protect the legs.

Coveralls should be made of a tightly woven fabric, such as cotton or polyester or of a non-woven fabric. They should fit loosely. Unless there is a layer of air between the coverall and the skin, any chemical that gets through the coverall will be in direct contact with the skin. Each layer of clothing worn under the coverall adds not only a layer of material, but also a protective layer of air. Well-designed coveralls have tightly constructed seams and snug, overlapping closures that do not gap or become easily unfastened.

Rubber or chemical-resistant aprons are needed when handling liquids for prolonged periods of time, or when handling concentrated chemicals. Wear an apron even if other protective clothing is also being worn. Keeping the skin clean and dry is always important, but the groin area is especially sensitive. Chemicals can penetrate the skin of the groin area more than 11 times more readily than through the forearm (Figure 11-1). A splash of a concentrated chemical here could result in a high dose of toxins entering the body very quickly.

Choose an apron that extends from the neck to at least the knees. Some aprons have attached sleeves, which can also protect the arms. Be aware that an apron can be a safety hazard in some situations. It can get in the way or get caught in machinery. In these situations, consider wearing a chemical-resistant suit instead.



**Figure 11-1. Absorption rates of chemicals through the skin of various parts of the body. Numbers are rates of absorption in comparison to the forearm.**

Chemical-resistant suits are often disposable and are made from a variety of materials that provide varying levels of protection and comfort. They may be one-piece coveralls or two-piece outfits consisting of a jacket worn over overalls or pants. Chemical-resistant suits can be uncomfortably warm to wear. Take precautions to avoid overheating and heat stress. These garments should be disposed of when damaged or contaminated, especially if contaminated with concentrated chemicals.

### *Respiratory Protection*

**WARNING: Use only respirators approved by the National Institute for Occupational Safety and Health (NIOSH) or the Mine Safety and Health Administration (MSHA) for the hazards present in the workplace.**

Operators may be exposed to many irritating and potentially harmful airborne contaminants while working at a wastewater land application facility. Examples of air contaminants include particles of pollen, bacteria, mold spores, wastewater aerosols, hazardous chemicals, and engine exhausts. The respiratory system is one of the easiest ways contaminants can enter our bodies.

One problem with occupational illnesses is that the worker may not associate the illness with job-related exposures. Symptoms of respiratory illness may be mistaken for the flu, common cold, or simple exhaustion.

Another problem is that people may perform a particular task for years without experiencing adverse health effects, but suddenly experience a severe reaction to even slight exposures to contaminants. The body can become 'sensitized' and no longer tolerate even small exposures to a substance. Additionally, some exposures can lead to permanent lung injury and disability.

Selecting and using a respirator involves more than simply purchasing one and putting it on. Using the wrong respirator, or using a respirator improperly, can result in serious illness or death. The respirator must be selected for the specific contaminant(s) in your workplace, and it must fit properly. In addition, the respirator must be properly cleaned, inspected, and stored after each use to prolong its life and help ensure protection for later uses.

The best way to select a respirator is to consult an industrial hygienist or other similarly qualified professional. If respirators are needed, these professionals can assist with selection, fit testing and training you and your employees to use the respirator properly. Additionally, a written respiratory protection program must be developed that specifies how these tasks will be accomplished.

There are two basic types of respirators: air-purifying respirators and air-supplying respirators.

- **Air-purifying respirators** remove contaminants from the air by filtering dust, mists, and particles or by removing gases and vapors. These respirators will not protect an operator from fumigants, from high concentrations of vapor, or when the oxygen supply is low. There are several styles of air-purifying respirators:
  - *Cup-style respirators* filter out dust, mists, powders and particles. They are usually shaped filters that cover the nose and mouth.

- *Cartridge respirators* are half-mask or full-face respirators that have chemical cartridges containing air-purifying materials. Many chemical cartridge respirators can be fitted with particulate pre-filters. By using the proper cartridges and pre-filters, it is possible to use chemical cartridge respirators in a variety of situations. Chemical cartridges are color-coded, so you can determine at a glance whether the correct respirator is in use. The cartridge needed depends on the particular contaminants present since different filter materials must be used for the various chemical hazards.
- *Canister respirators* (gas masks) are full-face respirators with attached canisters containing air-purifying materials. Canisters usually contain more air-purifying materials than cartridge respirators. The face-piece is designed to be cleaned and reused. Canisters can be replaced.

Air-purifying respirators pass air through the air purifying material in two ways. *Negative-pressure* respirators depend on the wearer's lungpower to draw air through the purifying material. *Powered air-purifying* respirators (PAPRs) assist the wearer by forcing air through mechanically. PAPRs purify contaminated air as it passes through the filter; they do not supply oxygen.

- **Air-supplying respirators** supply clean, uncontaminated air from an independent source. These are the only respirators that provide oxygen, and they can be used in oxygen deficient atmospheres, or atmospheres that are immediately dangerous to life or health.

There are two types of air-supplying respirators: the *supplied-air respirator* and the *self-contained breathing apparatus* (SCBA).

- A supplied-air respirator provides breathing quality air from an approved air pump located in a safe atmosphere or from a remote tank of breathing air. An SCBA supplies clean air from cylinders that are carried with the operator, usually on the back. Air-supplied respirators must be inspected and tested regularly and should only be used by specially trained individuals; use by untrained persons could lead to serious injury or death.

### 11.3

## Health and Safety Hazards



As an operator of a land application facility, you may be exposed to numerous common hazards:

- physical injuries
- infections and infectious diseases
- oxygen deficiency
- toxic or suffocating gases or vapors
- chemical contamination
- explosive gas mixtures

- fire
- electrical shock
- noise-induced hearing loss
- dust, fumes and mists
- heat exhaustion and heat stroke



## Health and Safety Measures

There are numerous safety practices, training, and equipment that an operator can use to minimize the risk of the hazards listed above. These include the following:

- process safety management and risk management programs
- confined space safety
- general site safety
- lockout/tagout policies
- electrical safety
- mechanical safety
- vehicle safety
- lagoon safety
- fire prevention and protection
- excavation and shoring safety
- medical safety

## OSHA Process Safety Management and EPA Risk Management Programs

The OSHA Process Safety Management and EPA Risk Management programs regulate how certain highly hazardous chemicals are to be used, stored, or manufactured. The goal of both programs is to prevent accidental releases of the substances that can cause serious harm to the public and the environment. If you store or have on site at any one time more than a *threshold quantity* of the chemicals listed below, then a process safety program and/or a risk management program may be needed. EPA and OSHA have slightly different listings and slightly different threshold quantities, and exemption from one program does not necessarily mean exemption from the other. Generally, if a wastewater treatment facility uses the chemicals in the amounts listed in Table 11-1, the facility will need to develop a program. Specific information on the OSHA program can be found in 29 CFR 1910.119, and specific information on the EPA program can be found in 40 CFR 68.

**Table 11-1. Threshold quantities for chemicals requiring a process safety program or risk management program (all quantities are in pounds).**

| Chemical                 | EPA Threshold Quantity | OSHA Threshold Quantity |
|--------------------------|------------------------|-------------------------|
| Chlorine                 | 2,500                  | 1,500                   |
| Anhydrous Ammonia        | 10,000                 | 10,000                  |
| Aqueous Ammonia          | >20% 20,000            | > 44% 15,000            |
| Anhydrous Sulfur Dioxide | 5,000                  | 1,000 (liquid)          |
| Methane                  | 10,000                 | 10,000                  |
| Propane                  | 10,000                 | 10,000                  |

## 11.4 Confined Space Safety

There are two types of confined spaces:

- A *confined space* has limited means of access (entry) and egress (exit), has an adequate size and configuration for employee entry, and is not designed for continuous worker occupancy.
- A *permit-required confined space* requires a permit for entry, may have a potentially hazardous atmosphere, may have an engulfment hazard, may have an entrapment hazard, or may contain any other recognized hazard.

If a facility has permit-required confined spaces, a written confined space entry program must be developed and implemented to be in compliance with OSHA regulations. Enclosed facilities used to handle wastewater or wastewater solids, such as tanks and/or tanker trucks, would fall under the permit-required confined space regulations.

**WARNING!** Do not enter a *permit-required confined space* without proper training, equipment and support personnel. (The confined space regulations can be found in the Code of Federal Register 29 CFR 1910.147.)

The atmosphere of a confined space may be extremely hazardous because of the lack of natural ventilation. This can result in the following dangerous situations:

- oxygen-deficient atmospheres
- flammable atmospheres
- toxic atmospheres

An *oxygen-deficient atmosphere* has less than 19.5% available oxygen (Figure 11-2). Any atmosphere with less than 19.5% oxygen should not be entered without an approved self-contained breathing apparatus (SCBA). Oxygen-deficient atmospheres may be found in sewers, manholes, septic tanks, and pump tanks.

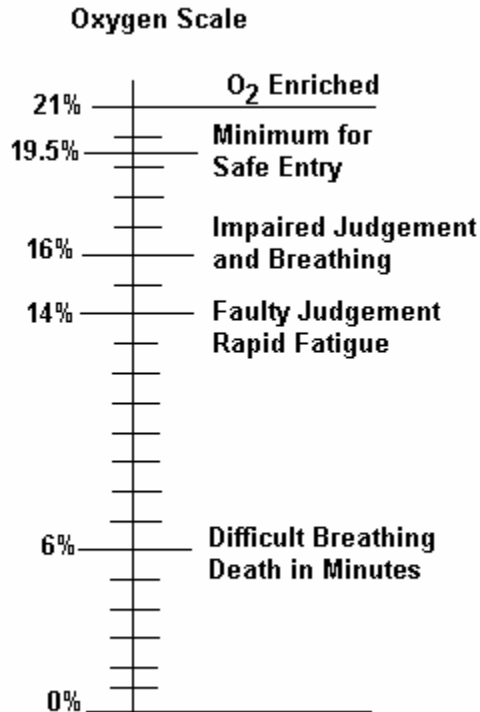


Figure 11-2. Oxygen scale (Confined Spaces 1988)

When working in a confined space that does not require a permit, the following safety actions must be taken:

- Use a ladder, hoist or other device when accessing these work areas.
- Verify that the confined space is clean and well ventilated. Test the atmosphere of the space, from the top of the work space to the bottom, for flammable/toxic gases and oxygen deficiencies PRIOR to entering the work space, and repeat testing during the work period.
- Use lifelines and always assign a standby person to remain on the outside of the confined space. It is the standby person's responsibility to be in constant contact (visually and/or verbally) with the workers inside the confined space as long as anyone is in the space.
- Wear ear protection, as needed. Noise within a confined space can be amplified because of the design and acoustic properties of the space.
- Be mindful of the possibility of falling objects when working in confined spaces.
- SCBA should be used in confined spaces where there is insufficient oxygen.

## 11.5 General Site Safety

A wastewater land application site should be restricted to authorized personnel. This restriction is necessary to prevent mishaps involving the public and to help ensure that the site and all equipment are protected from vandalism and theft.

Maintaining the land application site promotes a safe, well-kept working environment. Site maintenance includes the following:

- Keeping walks, aisles and access ways clear of tools and materials. It is also important to maintain clear access to electrical panels, control valves and fire extinguishers.
- Cleaning up puddles of oil, sludge, wastewater, or fuel promptly and thoroughly. Use absorbent material if necessary.
- Disposing of dirty and oily rags, used absorbent materials, trash, and other waste materials in approved containers. The waste should be removed from the site and disposed of properly.
- Providing scrap containers or scrap collection area where needed.
- Keeping the sanitary facilities clean.
- Keeping supply areas organized and free of hazards.
- Providing adequate illumination and ventilation.

## Lockout/Tagout Policy



A *lockout* is a padlock placed on a power source to block the release of hazardous energy that could set a machine in motion or otherwise endanger an employee working on the machine. Locks are usually used with a lockout device that holds an energy control point, such as a switch lever or valve handle in the “off” position, preventing machines or equipment from being operated while the machine is being worked on.

A *tagout* is a written warning that tells other workers not to operate a switch or valve that could release hazardous energy or set a machine in motion. Lockout is preferred because it is a more secure method of controlling and isolating hazardous energy sources. Although lockout/tagout policies most commonly refer to electrical energy, the following types should also be covered:

- mechanical
- hydraulic
- pneumatic
- stored
- chemical
- thermal

A written lockout/tagout program should be developed that specifies how individual machines or equipment will be taken out of and returned to service. Once the program has been developed, all employees who use or perform maintenance on any of the affected equipment must be properly trained.



## Electrical Safety

Treat all electricity and electric power equipment with caution: ordinary 120 V electricity can be fatal. Most wastewater treatment systems operate from 120 V to 4,000 V, or more.

In case of electrocution, turn off power to the electrical source or use an insulated implement, such as a piece of wood to separate the person from the source. Do not attempt to pull a victim away from the electrical source with your bare hands. The following is a list of general electrical safety practices (WEF 1996):

- Allow only qualified and authorized personnel to work on electrical equipment and wiring or to perform electrical maintenance.
- Provide and use lockout devices and tags at all locations.
- Always assume electrical equipment and lines to be energized unless they are positively proven to be de-energized and properly grounded. If the equipment is not grounded, it is not dead.
- Prohibit use of metal ladders or metal tape measures around electrical equipment.
- Ensure that two people always work as a team on energized equipment.
- Use approved rubber gloves on voltages more than 300 V.
- Do not open an energized electrical control panel.
- Before work is done on a line or bus that operates at 440 V or higher, be sure it is de-energized, locked out, and grounded in an approved manner.
- Do not test a circuit with any part of the body.
- Prevent grounding by avoiding body contact with water, pipes, drains, or metal objects while working on electrical equipment or wiring.
- Do not bypass or render inoperative any electrical safety devices.
- When working in close quarters, cover all energized circuits with approved insulating blankets.
- Use only tools that have insulated handles.
- Never use metal-cased flashlights.
- Do not wear jewelry when working with or near electric circuitry.
- Ground or double-insulate all electrical tools.
- Use rubber mats at control centers and electrical panels.
- Always keep electric motors, switches, and control boxes clean.



## Mechanical Safety

Mechanical safety guidelines apply to wastewater land application equipment, pressure-vacuum equipment, and hydraulic systems.



### *Wastewater Land Application Equipment*

Keep the following in mind when working on wastewater land application equipment:

- Always make sure that sprinklers, guns, hydrants, valves, and plugs are not pressurized when servicing or repairing wastewater land application equipment. Pressure can cause parts to blow off equipment, resulting in injuries.
- When servicing, always turn pumps off and de-pressurize lines by opening drain valves or opening discharge points to relieve water pressure.
- If you must clean a nozzle, operate an isolation valve and clean the nozzle when not under pressure.
- Always use the proper tools when working in valve boxes.
- These areas can be pinch points and are favorite havens of spiders and snakes, so be alert!
- Equipment such as traveling guns and center pivots (tractors) have many pinch points and moving parts. Always keep equipment guards in place, always tie back long hair, and do not wear loose clothing when operating this type of equipment.
- Be familiar with operational parameters from manufacturers' literature.
- Have a qualified electrician install and service all electrical systems for this type of equipment.
- Operating traveling guns (or hard-hose travelers) on steep and complex terrain can present safety concerns. Slopes up to 15 percent (and possibly slightly higher) can be effectively managed with traveling guns. However, the guns should be traversed across the slopes in an "up and down" fashion as opposed to pulling the gun sideways across the slope. If the gun is pulled sideways across the slope, the potential for a flipped gun cart is much greater. Should a gun cart flip, the system continues to apply wastewater from whatever position the sprinkler gun is in, creating a safety hazard.
- Gun carts typically have an adjustment that allows the wheel or track width to be increased. The widest footprint possible should be used on sloping terrain.
- Side slopes above eight percent should be avoided if a sideways pull must be used.
- Travel lanes for gun carts should be inspected for steeply sloping areas, gullies, tree roots, rocks, or any other disturbances in a field. These all have the potential to cause the gun cart to come off track or flip over. These situations must be corrected, or another travel lane selected, to use the field safely.
- Machine guarding: Any machine part, function, or process that may cause injury, must be safeguarded. Safeguards are needed in the following locations:

- At the point of operation, where the machine contacts the material and performs operations, such as cutting, punching, grinding, boring, forming or assembling.
  - Near power transmission components such as pulleys, belts, connecting rods, cams, chains, sprockets, cranks, and gears
  - At other parts of the machine that move (rotation, reciprocating movement, transverse movement) while the machine is working.
- Operate machinery only if you have been trained and authorized to use it.
  - Do not wear jewelry on the job.
  - While gloves are recommended for many tasks, do not wear them in situations where they could get caught and draw you into a machine.
  - Do not try to adjust or reposition material while a machine is running.
  - Wear the appropriate PPE equipment.
  - Always operate machinery with the safeguards in place. Report missing or damaged safeguards to the site supervisor.

### *Pressure/Vacuum Equipment*

The proper venting of storage tanks is imperative. Pressure relief valves must be kept in good working condition. In addition, the following venting procedures should be used when operating equipment:

1. Vent tank (so there is no pressure or vacuum) by opening hatches or manholes.
2. Do not go on top of a tank when it is under pressure, as the pressure relief valve can operate at any time.
3. When opening a pressurized tank's manhole cover after the pressure has been relieved, always open the clamping devices next to the hinge first. Open the clamp with the safety catch last.
4. Relieve the pressure in the hose before disconnecting it to avoid possible injury from unrestrained action of the hose or spill of wastewater.
5. Do not restrict or block off safety valves or blow-down lines.
6. The accumulation of gases within a confined space offers the potential for the vessel to explode or relieve the pressure at a weak point. ALWAYS stay to the side of all covers when opening. NEVER stand with your head or body over the cover when opening.

### *Hydraulic Systems*

When working on hydraulic systems, observe the following guidelines:

1. Do not open pressurized lines. Hydraulic fluid can cause severe burns, eye injury, or skin irritation.
2. Search for leaks in the line using a piece of cardboard or wood, not your hands.

3. If anyone is injured by hydraulic fluid: first, administer first aid; then contact a physician.
4. Stay clear of leaky hydraulic lines.

## 11.6 Land Application Site Vehicle Use

Only employees with a current, valid Idaho driver's license should drive vehicles. In the case of specialized vehicles, only trained operators should operate the vehicles. When operating heavy equipment vehicles and heavy over-the road vehicles observe the following rules:

- Make sure everyone is clear of the vehicle before starting.
- Slight steering movement can occur as the engine starts, causing machine movement. Stay clear of the engine when it is running.
- Work on the engine only when it is off.
- Carefully inspect trucks or trailers before moving to ensure that material and equipment are properly loaded and secure.
- Loads on trucks and trailers should not exceed rated capacities.
- Securely couple trailers to the towing vehicle when towing.
- Secure all trailers with safety chains or cables, except those attached to a tractor by a "fifth wheel."

## Heavy Off-The-Road Vehicle Operation

When operating heavy off-the-road vehicles, observe the following guidelines:

- Drive at a safe, legal speed to ensure safety and complete control of the vehicle, especially over rough terrain.
- Unless the vehicle is designed for more than one person, no one other than the operator should be on the vehicle.
- Always observe the speed limits of local landowners.
- Yield the right-of-way to local trucks and local road maintenance machinery.
- Use chock blocks on the tractor and trailer when the driver leaves the vehicle.

## 11.7 Lagoon Safety

When working on or around a wastewater lagoon, observe the following safety guidelines:

- Never go out on the lagoon to sample, or for other purposes, by yourself. Another worker should always be standing by in case of emergency.
- Always wear an approved life jacket when you are working from a boat on the surface of the lagoon.

- Never stand up in a boat while performing work.
- If it is necessary to drive a vehicle on a dam, make sure the roadway is maintained and is in good driving condition. Be extremely cautious when driving on dams during wet weather.
- Routinely inspect and fix potholes, ruts and rodent tunnels in berms or dams
- If you must walk on the inside sideslope, you should be harnessed and attached to prevent sliding into the lagoon.

## 11.8 Fire Prevention and Protection

It is important to be fire-conscious in the outdoor environment. Employees should be knowledgeable of the fire conditions at the site and operate accordingly. Poor site maintenance, worn or defective electrical systems, and welding and cutting may contribute to dangerous situations. The following precautions should be observed:

- Do not smoke near equipment or fuel trailers.
- Do not allow open flame near wastewater storage areas.
- Do not allow wastepaper, rags, and other combustible materials to accumulate.
- Do not tamper with, or remove, fire-fighting equipment from designated locations for purposes other than fire fighting or rescue operations.
- Do not hinder access to fire equipment.
- Promptly recharge fire extinguishers if they are used.
- Inspect fire extinguishers monthly to be sure they are in good operating condition.

## 11.9 Medical Safety

Medical safety at wastewater land application sites needs to address several areas, including first aid, pathogen awareness, eyewash stations, immunization, personal hygiene, and safety lifting/carrying activities.

### First Aid Training

There should be present, or available at all times, a person (or persons) with first aid training. If the wastewater land application site is more than fifteen minutes away (including transport time) from a clinic, hospital, or physician, OSHA requires a designated person qualified in first aid and CPR training to be present at all times. The training should include but not be limited to the following:

- bleeding control and bandaging
- artificial respiration, including mouth-to-mouth resuscitation
- poisons

- shock, loss of consciousness, stroke
- burns
- heat stress, heat stroke
- frostbite, hypothermia
- strains, sprains, hernias
- fractures and dislocations
- bites and stings
- transportation of the injured
- specific health hazards likely to be encountered by co-workers

There should be adequate first aid kits and supplies on site and readily available. A list of all employees with first aid qualifications should be posted, along with a list of emergency telephone numbers.

## Blood-borne Pathogen Awareness

All workers at a wastewater land application facility should be aware of the potential for contracting a blood-borne disease, such as hepatitis A or tetanus. *Human Immunodeficiency Virus* (HIV) is also considered a blood-borne pathogen and precautions should be taken when in direct contact with wastewater or sewage. One study has shown that HIV can survive in wastewater for up to twelve hours. OSHA requires an employer to provide specific training and personnel protective equipment for your job if a blood-borne pathogen exposure is expected by job classification. Components of such a program include the following:

- safe work practices
- use and care of PPE
- housekeeping
- employee training
- incident reporting
- employee medical monitoring

## Eyewash Stations

Suitable facilities for quick drenching or flushing of the eyes and body should be provided in areas where the eyes or body of any person may be exposed to injurious chemicals and materials. Eyewash equipment can either be portable or permanently installed. Both styles of dispensers allow a gentle trickle of water to flow across the eye.

If someone's eyes have been exposed to a chemical, such as chlorine gas, the eyes should be flushed for at least 15 minutes to dilute and remove as much of the chemical as possible.

Medical professionals should be consulted for any eye injury.

## Immunization

Each facility may want to consult a physician or the local health department to determine the need for immunizations for the employees working at the site. Adult tetanus and diphtheria should be given routinely every 10 years, or at shorter intervals when injury occurs.

## Personal Hygiene

Because wastewater contains pathogens, good personal hygiene is very important to reduce exposure. Good personal hygiene includes the following:

- Keeping your hands away from your nose, mouth, eyes and ears to avoid ingestion of wastewater.
- Wearing protective clothing (such as non-permeable gloves) when handling any equipment covered with wastewater.
- Taking special care (e.g., protective, waterproof dressing) to keep any area of broken skin covered to avoid possible infection. If a worker suffers an injury that results in an open wound or laceration, they should be given a tetanus booster.
- Washing hands thoroughly with soap before smoking, eating, drinking, or after work.
- Changing and washing work clothing daily.
- Washing any areas that come into contact with wastewater thoroughly with water and soap.
- Sponging any cuts with an antiseptic solution and covering with a clean, dry gauze dressing and waterproof adhesive.

## Safe Lifting and Carrying Techniques

Everyone should observe the following guidelines to avoid possible injury when lifting and carrying objects:

- Test the load first and do not move more than is comfortable.
- Set your feet far enough apart to provide good balance and stability (approximately the width of your shoulders).
- Get help for large, bulky or heavy items.
- Get as close to the load as practical, and bend your legs about 90 degrees at the knees.
- Straighten your legs to lift the object, and, at the same time, bring your back to a vertical position—the objective is to use your legs to lift rather than your back.
- Never carry a load that blocks forward vision.
- To lower the object, repeat the stance and position for lifting: bend the legs to 90 degrees and lower the object.

- When lifting an object with another person, be sure that both individuals lift at the same time and put the load down together.

## 11.10

## Public Health and Safety



In addition to striving to protect the health and safety of employees, coworkers, and themselves, wastewater land application system owners and operators also have a responsibility to protect the health and safety of the public.

The general public is often unaware of the dangers associated with a wastewater land application facility, so a land application site should be restricted to authorized personnel to prevent exposure of the public to physical injuries and to possible contamination from pathogens and *vectors* (animals or organisms capable of transporting infectious agents).

By properly operating and maintaining the system (thereby reducing the risk of spills, overflows, excessive drift and runoff), an operator reduces the risk of contaminating ditches, waterways, and adjoining properties. This, in turn, protects the public from contact with contaminated surface waters or ground water. If spills or discharges do occur, rapid mobilization of a well-thought out and well-practiced emergency response plan can minimize the health and safety threat to the public.

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State of North Carolina, 2001. Spray Irrigation System Operators Training Manual.

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